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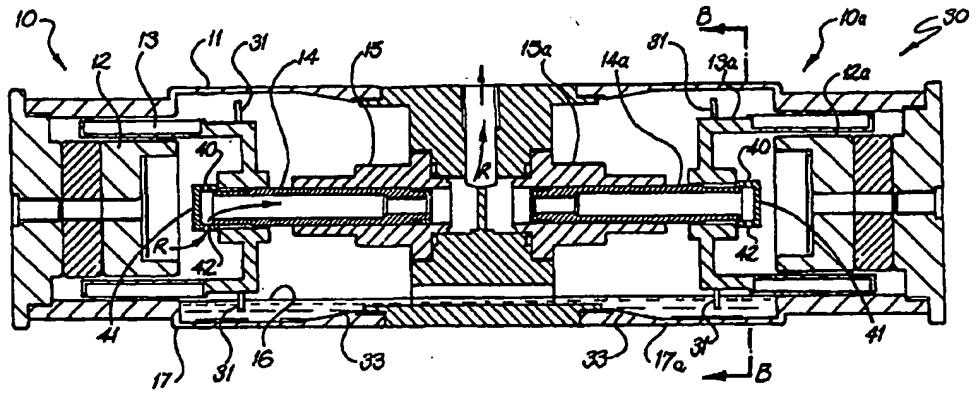
(54) Title: SINGLE AND DOUBLE-ENDED COMPRESSORS



(57) Abstract

A double-ended refrigerant compressor (30) consists of a pair of opposed compressors (10a) each of which has a hollow piston (14, 14a) that is driven by an armature (13, 13a) under the influence of electrical coils (12, 12a) to compress refrigerant in the chambers (15, 15a). The armatures (13, 13a) have oil slingers (31) to splash oil from the sump (17, 17a) to the pistons (14, 14a) and chambers (15, 15a). A cap (41) may be fitted over the inlet end of the pistons (14, 14a) to minimise oil loss.

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SINGLE AND DOUBLE-ENDED COMPRESSORS

FIELD OF THE INVENTION

This invention relates to linear refrigerant compressors and more particularly to the oiling of such compressors including double-ended linear compressors.

BACKGROUND ART

A linear refrigerant compressor consists of an armature with a piston attached to it and a barrel where the refrigerant gas is compressed by the piston. The armature moves backward and forward in a linear motion. The energy associated with this movement is transferred to the body of the compressor.

In a single-ended compressor only one armature is moving, and thus the whole body of the compressor will be vibrating as well. This vibration creates splashes of oil that help to lubricate the barrel and piston of the compressor.

In a double-ended compressor the armatures are moving together with the same amplitude, but in opposition directions. So that the total energy transferred to the body is almost zero i.e. the compressor is not vibrating.

Although the lack of vibration makes the compressor quiet, it creates a problem with the oiling as there is nothing to stir up the oil. This can lead to poor lubrication of the barrel and piston and to seizing of the compressor.

A similar problem will arise in respect of a single-ended compressor made with a passive resonator which incorporates some other method of eliminating vibration.

It is an object of this invention to overcome this problem by adding a means to stir up the oil as the armature moves backward and forward.

SUMMARY OF THE INVENTION

According to one aspect of the invention there is provided a

single-ended linear refrigerant compressor comprising a body, an electrical winding, an armature driven by the winding, a refrigerant chamber or barrel and a piston carried by the armature that is driven forward and backward in the barrel to compress refrigerant and wherein the body has an oil sump and at least one oil slinger adapted to splash oil from the sump to the barrel and piston.

According to another aspect of the invention there is provided a double-ended linear refrigerant compressor comprising a housing defining a pair of opposed bodies each having an electrical winding, an armature driven by the winding, a refrigerant chamber or barrel and a piston carried by the armature that is driven forward and backward in the barrel to compress refrigerant therein and wherein the housing has an oil sump and at least one oil slinger adapted to splash oil from the sump towards each barrel and piston.

Preferably, the or each oil slinger is mounted on the armature.

In a preferred embodiment of the invention, a plurality of oil slingers are spaced evenly around the periphery of each armature.

The or each piston has an inlet port for the refrigerant and in order to minimise oil loss, the piston inlet may be covered by a cap having a plurality of passageways around its periphery disposed at an angle to the line of movement of the piston.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross-sectional view of a single-ended refrigerant compressor according to the prior art,

Fig. 2 is a cross-sectional view of a double-ended refrigerant compressor according to the prior art,

Fig. 3 is a cross-sectional view of a double-ended refrigerant compressor according to one embodiment of the invention,

Fig. 4 is a view taken along lines A-A of Fig. 3,

Fig. 5 is a view similar to Fig. 3 of another embodiment of the invention,

Fig. 6 is a view taken along lines B-B of Fig. 4,

Fig. 7 is an enlarged view of one piston of the double-ended refrigerant compressor shown in Fig. 3 which has a modified cap,

Fig. 8 is an enlarged front end view of the cap shown in Fig. 7, and

Fig. 9 is an enlarged side view of the cap shown in Fig. 7.

MODES OF PERFORMING THE INVENTION

The prior art single-ended refrigerant compressor 10 shown in Fig. 1 includes a body 11 that has an electrical winding 12 that drives an armature 13 in a reciprocating manner. A piston 14 carried by the armature 13 is driven backwards and forwards in the chamber or barrel 15 compressing refrigerant gas during its forward stroke.

Within the body 11 there is a quantity of lubricating oil 16 which, when the piston 14 is stationary, is located in the sump 17. When the compressor 10 is operating, the linear motion of the armature imparts vibration to the body of the compressor which in turn creates splashes of oil that lubricate the barrel 15 and the piston 14.

The double-ended compressor 20 shown in Fig. 2 consists of opposed single-ended compressors 10, 10a which have a body 11, 11a, an electrical winding 12, 12a, an armature 13, 13a, piston 14, 14a, barrel 15, 15a, sump 17, 17a and oil 16 and 16a. The armatures 13 and 13a are driven by the windings 12 and 12a with the same amplitude but in opposite direction with the end result that the total energy transferred to the bodies 11 and 11a is almost zero

and thus there is little, if any, vibration of the double-ended compressor 20 as a whole.

This lack of vibration leads to poor lubrication of the pistons 14 and 14a and barrels 15 and 15a as less oil is being splashed onto the pistons and barrels.

The double-ended refrigerant compressor 30 shown in Figs. 3 and 4 is substantially similar to that shown in Fig. 2 except that a plurality of oil paddles or slingers 31 are mounted around the periphery 32 of the armatures 13 and 13a. As can be seen in Fig. 4, the slingers 31 are long enough to pass through the sump 17 and 17a to splash the oil around the bodies 11 and 11a and onto the pistons 14 and 14a and barrels 15 and 15a to lubricate them.

In this instance, there are 8 slingers 31 spaced evenly around the periphery 32 of the armatures 13 and 13a to take account of any disposition of the armatures 13 and 13a around the windings 12 and 12a during assembly and operation of the compressor.

As shown in Fig. 4, this embodiment of the invention provides two slingers 31 in the sump 17 and 17a at the one time but this need not be so. A single slinger 31 can be used. The shape and configuration of the or each slinger 31 is determined according to operational requirements for the lubrications of the compressor.

The compressor shown in Figs. 5 and 6 is substantially similar to that shown in Figs. 3 and 4 and thus the same numerals are used for the same components. The embodiment of the invention shown in Figs 5 and 6 has been devised to address a problem that can arise in relation to oil leaving the compressor. Refrigerant flow is in the direction of arrows R.

Part of the oil 16 stirred up by the slingers 31 can enter the inlet port 40 of the pistons 14 and 14a and then pumped via the inlet and outlet valves from

the compressor into the system. This can lead to a situation where a large part of the oil is pumped out of the compressor resulting in poor lubrication of the piston and barrel.

To prevent or at least alleviate this problem, the inlet ports 40 are provided with a cap 41 that has a plurality of passageways or gas inlet ports 42 around its perimeter that are directed at angles of 90° to the line of movement of the pistons 14 and 14a. The purpose of the holes 42 is to allow the refrigerant to enter the suction ports 40 but to prevent or at least hinder the oil 16 entering the inlet ports 40. The holes are, in this instance, approximately 1 to 2mm in diameter.

The cap 50 shown in Figs. 7 to 9 , has an end portion 51 and a skirt portion 52 which engages the end of the piston 14 with has inlet ports 53 spaced around the end of the skirt portion 52 allowing gas to enter the suction port 40. Ribs 54 around the interior of the skirt portion 52 between the inlet ports 53 provide a press fit of the cap 50 onto the piston 14 when the cap 50 is pressed up against the piston-supporting collar 55 carried by the armature 13.

Various other modifications may be made in details of design and construction without departing from the scope and ambit of the invention. For example, the or each oil slinger could be mounted on the spring that is positioned between the armature and the barrel.

CLAIMS

1. A single-ended linear refrigerant compressor comprising a body, an electrical winding, an armature driven by the winding, a refrigerant chamber or barrel and a piston carried by the armature that is driven forward and backward in the barrel to compress refrigerant and wherein the body has an oil sump and at least one oil slinger adapted to splash oil from the sump to the barrel and piston.

2. A double-ended linear refrigerant compressor comprising a housing defining a pair of opposed bodies each body having an electrical winding, an armature driven by the winding, a refrigerant chamber or barrel and a piston carried by the armature that is driven forward and backward in the barrel to compress refrigerant therein and wherein the housing has an oil sump and at least one oil slinger adapted to splash oil from the sump towards each barrel and piston.

3. A refrigerant compressor according to claim 1 or claim 2 wherein the or each oil slinger is mounted on the or each armature.

4. A refrigerant compressor according to claim 3 wherein there is a plurality of oil slingers extending outwardly from the periphery of each armature.

5. A refrigerant compressor according to any one of the preceding claims wherein the or each piston is hollow and has an inlet port for the refrigerant and further including a cap over the piston inlet, said cap having a plurality of passageways around its periphery disposed at an angle to the line of movement of the piston to allow refrigerant to enter the piston

6. A refrigerant compressor according to claim 5 wherein the cap is a press fit over the inlet port of the hollow piston.

7. A refrigerant compressor according to claim 6 wherein the cap has an end portion and a skirt portion surrounding the inlet port of the hollow piston and wherein the passageways are formed in the skirt portion.

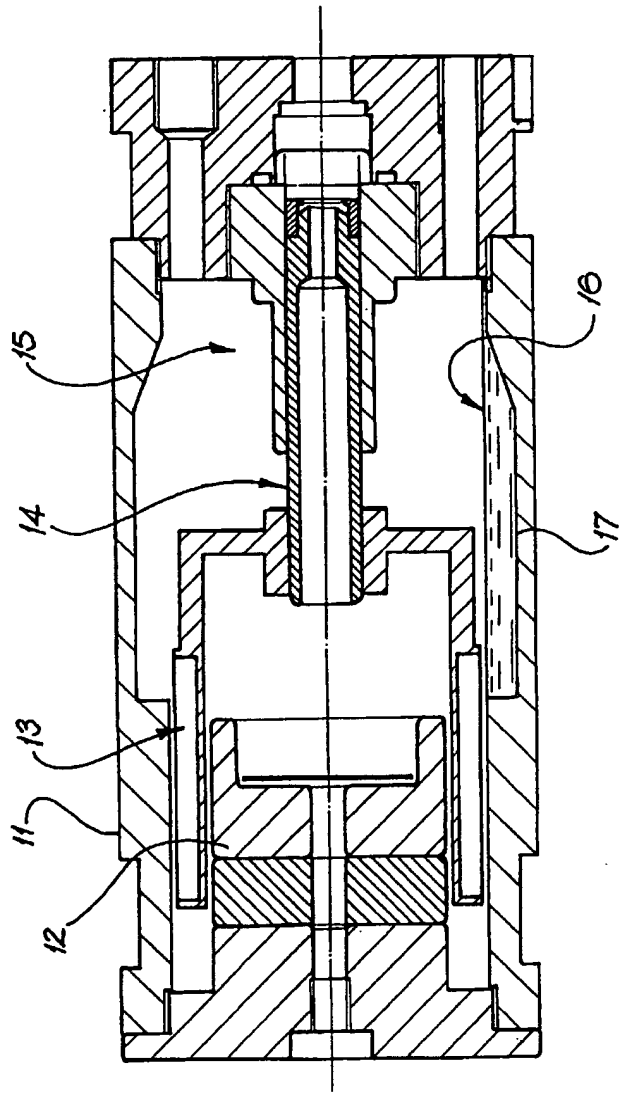


FIG. 1

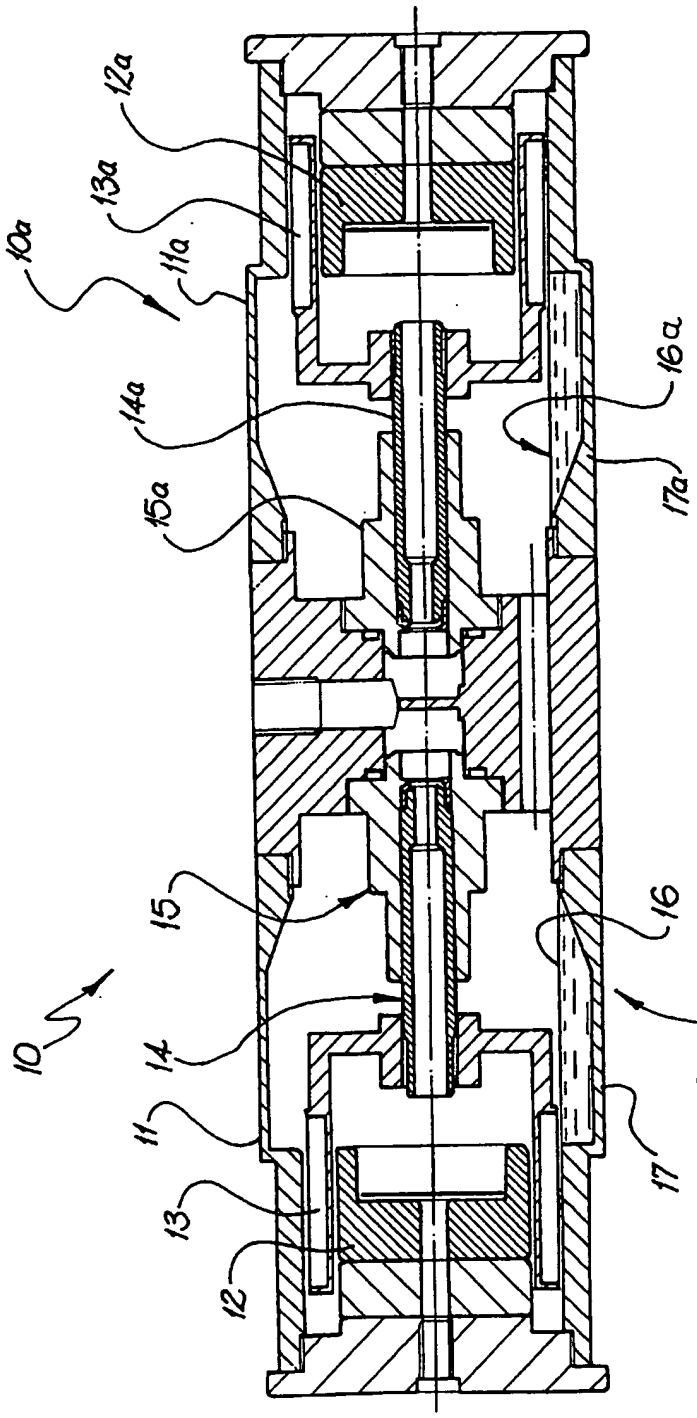
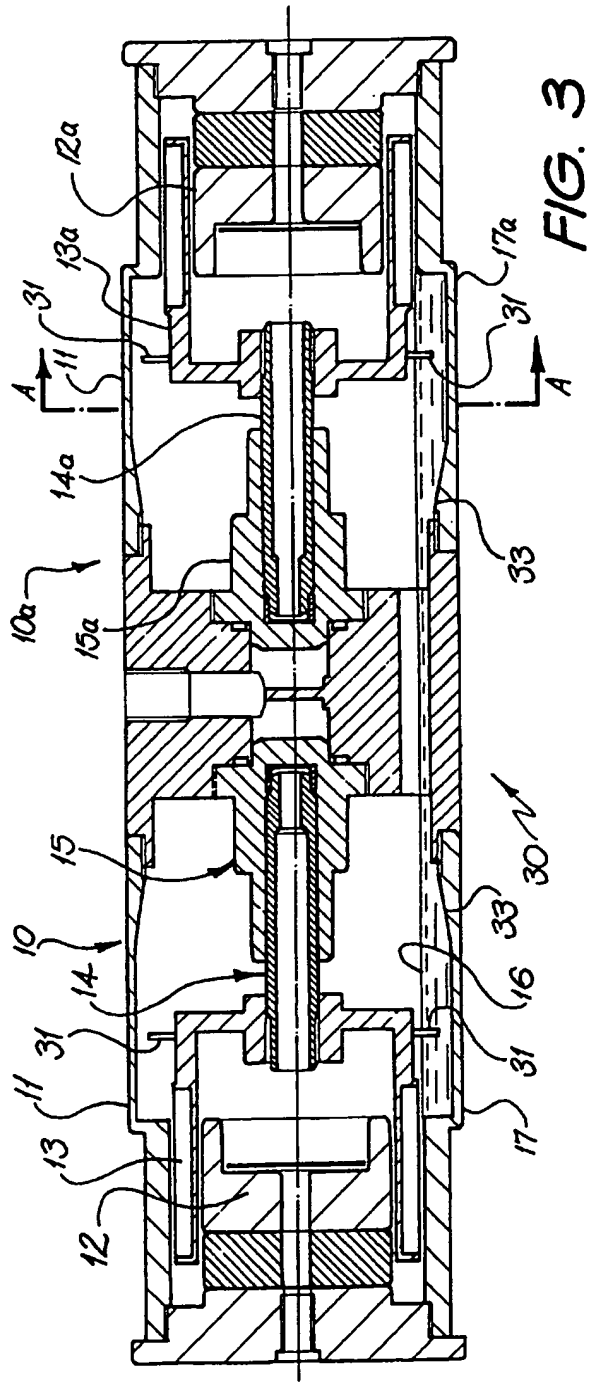


FIG. 2


12a
13a
31
11
A
14a
10a
15a
15
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14
31
11
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12
17a
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A
33
30
33
16
31
17

FIG. 3

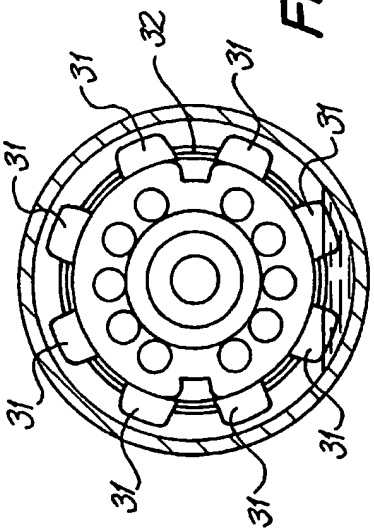
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FIG. 4

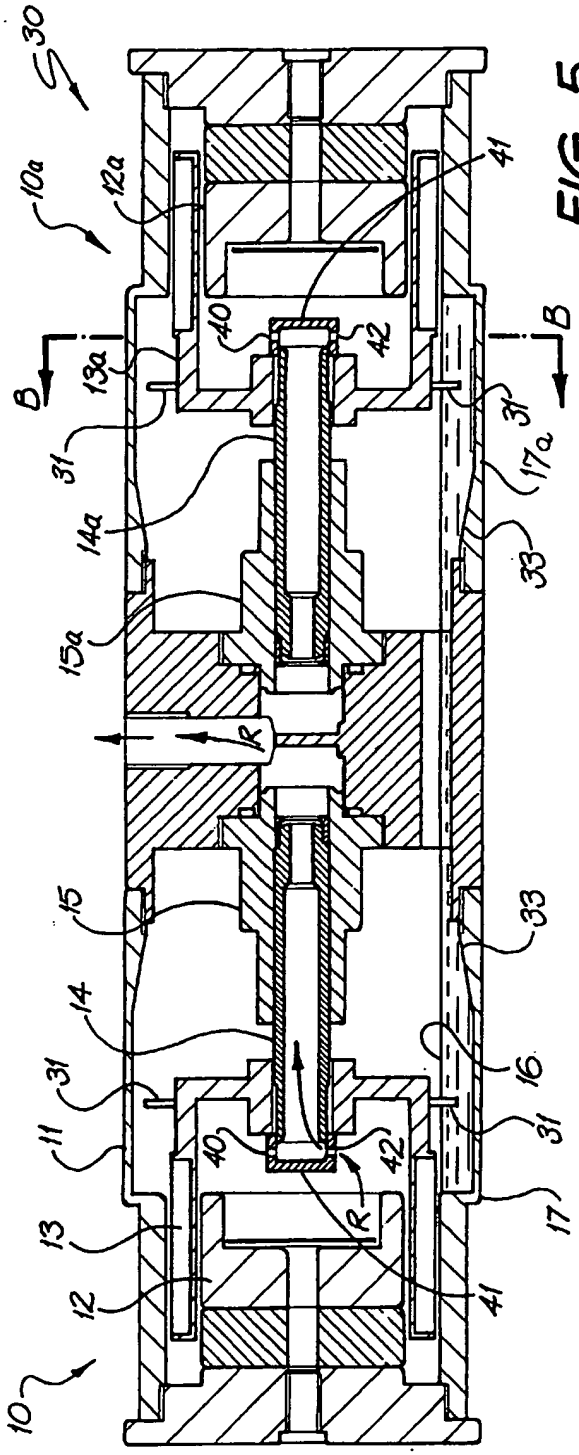
30
10a
12a
41
40
42
B
B
13a
31
14a
15a
17a
33
R
15
14
16
11
13
12
10
17

FIG. 5

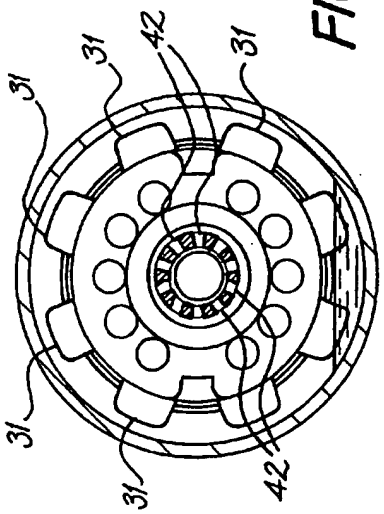
31
42

FIG. 6

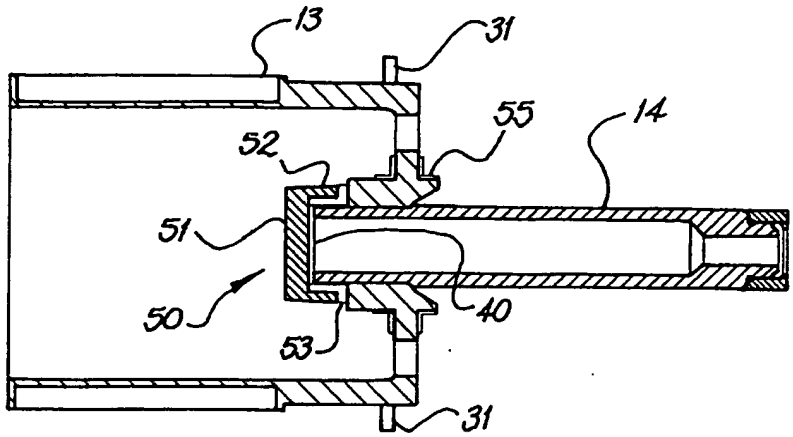

FIG. 7

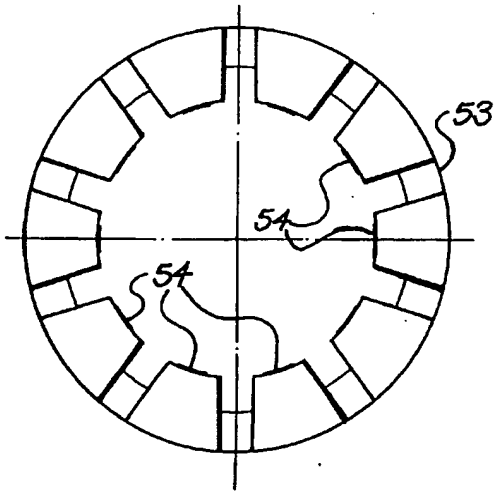

FIG. 8

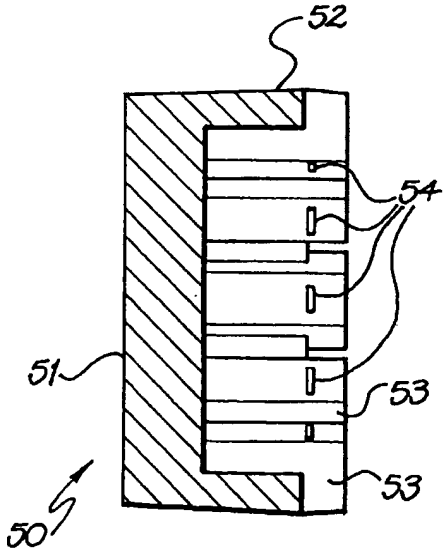

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 99/00797

A. CLASSIFICATION OF SUBJECT MATTER

Int Cl[6]: F25B 1/02, 31/02 F04B 39/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F25B 1/02, 31/02 F04B 39/02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No. 97-018722/02, Class x25, x27 JP 08-284832A (MATSUSHITA) 29 October 1996 See abstract	1
A	Derwent Abstract Accession No. 96-516267/51, Class Q56 JP 08-270560A (IWAJA TOSOKI) 15 October 1996 See abstract	
A	Derwent Abstract Accession No. 97-068170/07, Class Q75 JP 08-313093A (SANYO) 29 November 1996 See abstract	

[X] Further documents are listed in the continuation of Box C

[ ] See patent family annex

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Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/AU	Authorized officer
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INTERNATIONAL SEARCH REPORT

International application No. PCT/AU 99/00797

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MICRO COMPRESSORS TECHNOLOGY PTY. LIMITED [/]; (). DIMANSTEIN, Isaac [/]; (). HUNT, Russell [/]; (). DIMANSTEIN, Isaac [/]; (). HUNT, Russell [/]; (). MAXWELL, Peter, Francis ; ().

Published

(54) Title: SINGLE AND DOUBLE-ENDED COMPRESSORS

(54) Titre: COMPRESSEURS A SIMPLE ET DOUBLE EXTREMITE

(57) Abstract

A double-ended refrigerant compressor (30) consists of a pair of opposed compressors (10a) each of which has a hollow piston (14, 14a) that is driven by an armature (13, 13a) under the influence of electrical coils (12, 12a) to compress refrigerant in the chambers (15, 15a). The armatures (13, 13a) have oil slingers (31) to splash oil from the sump (17, 17a) to the pistons (14, 14a) and chambers (15, 15a). A cap (41) may be fitted over the inlet end of the pistons (14, 14a) to minimise oil loss.

(57) Abrégé

Cette invention se rapporte à un compresseur de réfrigérant à double extrémité (30) qui est constitué par une paire de compresseurs opposés (10a) comportant chacun un piston creux (14, 14a) mû par une armature (13, 13a) sous l'action de bobines électriques (12, 12a) de façon à comprimer le réfrigérant dans les chambres (15, 15a). Les armatures (13, 13a) comportent des déflecteurs d'huile (31) destinés à projeter l'huile du carter d'huile (17, 17a) vers les pistons (14, 14a) et vers les chambres (15, 15a). Un obturateur (41) peut être adapté sur l'extrémité d'entrée des pistons (14, 14a) pour réduire les pertes d'huile au minimum.